PROMPT AIR-SCATTERING CORRECTIONS FOR A FAST-NEUTRON FISSION DETECTOR: $E_n \leq 5$ MeV

by

Donald L. Smith

ABSTRACT

Neutrons which have scattered many times in surrounding air and in laboratory objects arrive randomly in time at a detector and can be discriminated by time-of-flight techniques. Neutrons which have scattered only a few times in air reach the detector soon after the primary neutron burst and cannot be distinguished from the latter by time conditions. Most of the prompt air-scattered neutrons have undergone only one elastic collision and it has been shown that the ratio of these singly-scattered to primary neutrons increases linearly with distance from a point source. The energy, time and angular distributions of neutrons which scatter once in surrounding air before reaching a fission detector have been calculated for E_n = 0.05 - 5 MeV using published cross sections. Data corrections for prompt air-scattered neutrons are generally small but not necessarily negligible in high-precision measurements. For example, it has been calculated that this effect leads to a correction of $\sim$ 0.2 - 0.3% in a measurement at E_n = 1.5 MeV of the U-238 to U-235 fission cross section ratio if the back-to-back uranium deposits in a double fission detector are situated 10 cm from the neutron source. This correction is significant since $\lesssim$ 1% accuracy is currently sought in fission cross section ratio measurements.